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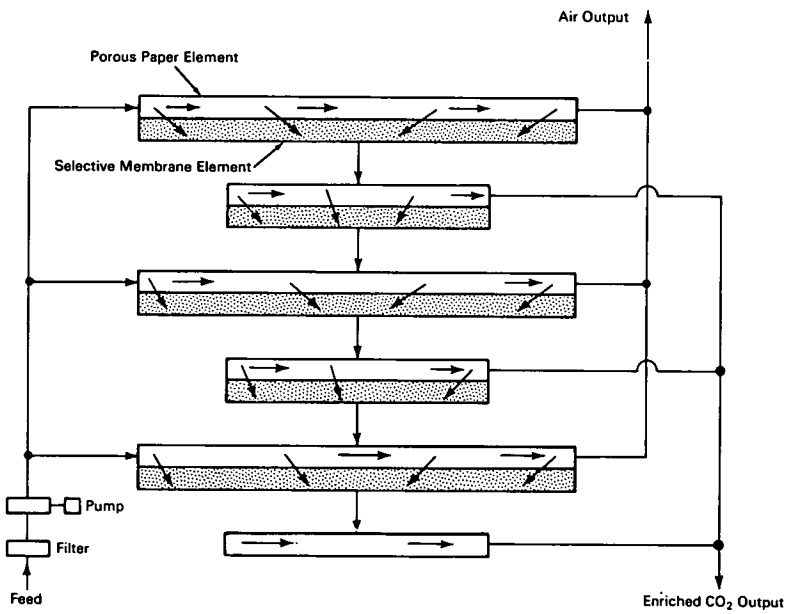
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

Gas Diffusion Cell Removes Carbon Dioxide from Occupied Airtight Enclosures



The problem: The design and fabrication of a compact, regenerative unit for removal of CO_2 gas from respiratory air in an enclosed area.

The solution: A small, lightweight permeability cell package that separates and removes CO_2 from respiratory gas mixtures. The cell is totally regenerative while chemically inert in the presence of CO_2 so that only adsorption takes place.

How it's done: The illustration shows a schematic flow of gases through a permeability cell package. Each cell is comprised of two layers, the top layer being a porous element made of ordinary paper that serves as a restrictive flow path for the main body of inlet gas. The bottom layer is a selective membrane made of a special silicone elastomer having a strong affinity for CO_2. Each cell layer is alternately crossed in order to prevent a short circuit of inlet and outlet flow paths. An epoxylated plastic compound is inserted between overhanging layers to ensure proper division of gas streams.

A gas mixture of spent air (Feed) containing oxygen, nitrogen, moisture, and CO_2 is filtered and pumped at low pressure through alternate paper elements. As the gases contact the silicone membrane, CO_2 and oxygen are adsorbed in a combined ratio of approximately 5 to 1. This composition passes through the next layer of paper where it flows out of the system as it is

(continued overleaf)

partially re-adsorbed into the mating silicone elastomer membrane. Separation of this latter portion of gas again is 5 parts CO_2 to 1 part oxygen, thus diminishing the quantity of oxygen in the composition considerably. As this mixture moves to the third paper cell, it blends with the inlet feed mixture for further CO_2 enrichment through succeeding membranes. Thus, the entire cascading diffusion process results in good separation of CO_2 from the initial air mixture. The outlet air is a mixture of nitrogen, oxygen, and moisture than can be dehumidified and circulated as fresh respiratory air for occupants of the enclosed space.

Notes:

1. This permeability cell would be useful in any situation where control of CO_2 levels benefits a product or condition.
2. The permeability cell package, using appropriate selective membranes, would be an excellent safety device in coal mines for the removal of dangerous gases, both suffocating and explosive types.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   P.O. Box 1537
   Houston, Texas, 77001
   Reference: B64-10319

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

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